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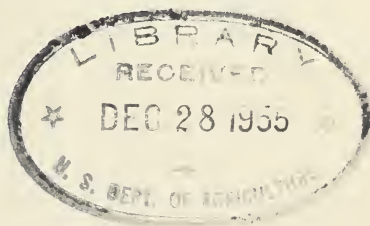
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**A GUIDE FOR THE
CONSTRUCTION
OF
FARM BUILDINGS**

**For Use in Construction
with
Farmers Home Administration
Loans** x



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NOVEMBER 1955

GENERAL

This booklet has been prepared for use as a guide in the construction and repair of dwellings and farm buildings to be built from the proceeds of loans insured or made by the Farmers Home Administration.

All new buildings and repairs financed with funds insured or loaned by the Farmers Home Administration shall be substantially constructed and in accordance with approved building plans and specifications.

COMPLIANCE WITH LOCAL REGULATIONS

All improvements to the property shall conform to all applicable laws, ordinances, and regulations which relate to the safety and sanitation of the buildings. This guide shall not be construed as lowering the requirements established by local laws, ordinances, or regulations. Wherever such local requirements contain more stringent provisions than the provisions set forth herein, the more stringent requirements shall govern.

PLANS AND SPECIFICATIONS

Plans and specifications should be accurate and sufficiently complete to describe the intended improvements.

DWELLINGS

The following information should be submitted:

Floor Plans.—(Including basement or foundation plan.) Direction, size, and spacing of all framing members should be shown.

Heating.—Either on separate drawings or appropriate floor plan, the following should be shown:

1. Size and layout of heating units, flues, pipes, ducts, registers, radiators, and any special arrangements.
2. Capacity in B. t. u. per hour of the heating plant.
3. Domestic hot-water equipment, size, and layout.

Plumbing Fixtures.—Location and size to scale should be shown.

Electric.—Location of entrance panel, switches, and outlets should be shown and types indicated.

Equipment.—Location and size to scale should be shown.

Exterior Elevations.—Openings and sizes, wall finish materials, flashing, finish grades, depth of footings, finish floor and ceiling heights, roof pitch, and heights of chimneys should be shown.

Details.—Details of wall construction above and below grade, including footings, floor, and roof construction, drawn to scale at not less than one-

half inch equals 1 foot should be shown. Design and construction, including any special items such as cabinet work or millwork, together with design and construction of individual water-supply or sewage-disposal systems, if any, should be indicated.

Specifications.—Specifications should fully describe the quality, kind, and grade of materials and equipment, quality of workmanship, and methods of assembly and installations.

SERVICE BUILDINGS

Similarly, service building floor plans, exterior elevations, details, and specifications should include the following:

Floor Plans.—(Including foundation plan.) Direction, size, and spacing of all framing members should be shown. If heating, plumbing, electrical, and other equipment is specified, it should be shown in the same manner as required for dwellings.

Exterior Elevations.—Openings and sizes, wall finish materials, finish grades, depth of footings, finish floor and ceiling heights, and roof pitch should be shown in exterior elevations for at least the front and one side.

Details.—Details of wall construction above and below grade, including footing, floor, and roof construction drawn to scale at not less than one-half inch equals 1 foot should be shown.

Specifications.—Specifications should fully describe the quality, kind, and grade of materials and equipment, quality of workmanship, and methods of assembly and installations.

PLANNING

SITE

For new buildings, a site should be selected which is well drained and not subject to hazards such as the probability of flood or erosion. All new buildings should be suitably located in relation to other buildings.

FINISH GRADING

All debris should be removed from the rough-graded area before finish grading. Finish grade elevations around building should provide continuous slopes away from foundation walls. The finished surfaces of all areas should be reasonably smooth and even. The height and steepness of slopes should be such as to provide stability and reasonable freedom from erosion. Where necessary, precautionary methods should be taken such as installations of retaining walls, sodding, or planting to stabilize the soil. Areas where lawns and planting are required should have suitable topsoil of adequate depths to support plant growth.

LANDSCAPING

Lawns and planting commensurate with the type of dwelling should be arranged to provide an attractive setting for the dwelling.

WALKS AND STEPS

Suitable outside steps and necessary walks to permit convenient access to the dwelling should be provided.

DWELLINGS

Each dwelling unit should provide suitable and desirable living, sleeping, cooking, and dining accommodations, and adequate storage and sanitary facilities ordinarily considered necessary to a permanent home.

ROOM SIZE

Rooms should be of such size and so planned as to permit the proper spacing of adequate furniture and equipment, appropriate to and essential for the use of the occupants.

BATHROOM

In new dwellings the plan should include either a bathroom or space for a future bathroom large enough to include a water closet, lavatory, and tub. The arrangement of fixtures should provide at least a 90-degree door

swing and comfortable use of each fixture. When the bathroom is equipped, a septic tank or other approved means for sanitary waste disposal should be provided.

CLOSETS

All bedrooms should be provided with at least 1 clothes closet, minimum size 2 feet deep and having a floor area of at least 6 square feet. When practicable, a coat closet near entrance and a linen closet near the bedrooms should be provided.

FOOD STORAGE

Sufficient space to meet the needs of the family should be provided for food storage. Food storage space should be conveniently located and provided with proper ventilation and protection from freezing and excessive heat.

KITCHEN

The kitchen should be properly equipped with a sink, cupboards, drawers, and adequate working surfaces. The sink should be connected with a drain which will dispose of the waste in a sanitary manner.

HEATER ROOM AND FUEL STORAGE

Where central heating plants are proposed, sufficient space for safety, arrangement, and clearance of all equipment, and the proper storage space for fuel should be provided. Clearances required for safety should be determined by the type of insulation of the heater and type of wall, floor, and ceiling covering.

LIGHT AND VENTILATION

Windows and doors should provide natural light and ventilation in all habitable rooms. Glazed window area for each such room should be at least 10 percent of the floor area. The possible open window area should be at least 4 percent of the floor area of room with no exterior door or 2 percent of floor area with an exterior door. The heater room should have sufficient ventilation to assure proper combustion and safety. Effective cross ventilation should be provided for all attic areas between top floor ceiling and the roof. If floor construction above a basementless space is of wood or metal and the space is not open to a ventilated basement, provide (a) at least four foundation wall vents near the corners to provide an aggregate free ventilating area equal to 1/160th of the ground area; or (b) ground surface treatment consisting of a layer of smooth asphalt roofing weighing at least 55 pounds per 108 square feet, lapped at least 2 inches, plus at least 2 foundation wall vents located for effective cross ventilation and with an aggregate free ventilating area of at least 10 percent of the above. In each opening, install corrosion-resistant screening, mesh 4 to 8 per inch.

ACCESS TO ATTIC AND BASEMENTLESS AREAS

Access should be provided to the attic by means of scuttles or disappearing or permanently installed stairs. Access to basementless areas should be provided with an access door (approximately 18 x 24 inches) in the wall.

CEILING HEIGHTS

Ceiling heights should be not less than 7 feet 6 inches.

DOORS

All doors should be sufficiently wide to provide for necessary passage of furniture and household equipment. All exterior doors should be not less than 2 feet 8 inches wide. All interior doors which provide access to habitable rooms should be not less than 2 feet 6 inches wide.

STAIRWAYS

The design for stairways should be such as to afford safety and provide adequate headroom and space for passage of furniture, giving particular attention to railings, landings, winders, treads, and risers.

SERVICE BUILDINGS

Service buildings should be planned to meet the needs of the farm.

CONSTRUCTION OF DWELLINGS

GENERAL

All portions of the structure subject to exterior exposure should be of such material and be so constructed and protected as to prevent entrance and penetration of moisture and weather.

Adequate precaution should be taken to protect materials and construction from damage by ordinary use, decay, corrosion, termites, and other destructive elements.

Workmanship should be of a quality equal to good standard practice, and the materials used should be of such kind and quality as to assure reasonable durability and economy of maintenance.

All parts of the structure should be properly designed to carry the loads without detrimental effect on the wall finish or roofing material.

Each member should be correctly fitted and connected.

The structure should be adequately braced against lateral stress.

Adequate precaution should be taken to protect against fire and other hazards.

CONCRETE AND MASONRY

SUPPORT OF MASONRY

All masonry, including veneer, should be ground-supported on masonry, concrete, or steel.

SILL AND PLATE ANCHORING

Sills and rafter plates should be anchored to concrete or masonry walls and, whenever practicable, to piers.

Embed anchor bolts or straps in masonry unit walls not less than 15 inches; in poured concrete, not less than 6 inches.

Spacing should not exceed 8 feet o. c.; at least 2 bolts in each piece.

CONCRETE WORK

Aggregates should be well graded, clean, hard, free from loam, clay and vegetable matter.

Plain Concrete.—One part portland cement, three parts sand, five parts coarse aggregate.

Reinforced Concrete.—One part portland cement, two parts sand, four parts coarse aggregate.

Placing Concrete.—Pour concrete continuously whenever possible and keep practically level throughout the length being poured.

When concrete is not poured continuously, clean, score, and wet the top surface before continuing. Key all vertical joints.

Spade and rod concrete thoroughly in forms.

MASONRY WORK

Mortar.—Mix should be as follows for uses indicated in paragraph, Mortar Uses, below:

Portland Cement Mortar.—One part portland cement, 3 parts sand by volume, and lime not exceeding 25 percent of the cement by volume.

Cement Lime Mortar.—One part portland cement, 1 part lime, and not more than 6 parts sand by volume.

Masonry Cement Mortar.—One part Type II masonry cement and not more than three parts sand by volume. No other material except water should be added to this mixture.

Mortar Uses.—Mortar for masonry below grade:

For walls 12 inches or more in thickness constructed of solid units, use any mix specified under Mortar.

For walls less than 12 inches thick constructed of solid units, and walls 12 inches or less constructed of hollow units, use mix specified in paragraph above for Portland Cement Mortar unless walls are dampproofed. If dampproofed, mix specified in paragraphs Cement Lime Mortar or Masonry Cement Mortar, may be used.

For walls of any thickness constructed of hollow units and not dampproofed, use mix specified in paragraph above, Portland Cement Mortar.

Mortar for masonry above grade—for all walls, use any mix specified in paragraphs above.

Joints.—Maximum thickness—three-fourths inch.

Bonding.—Brick masonry should be bonded with header course in every seventh course.

Rubble stone masonry should be bonded with bond stones evenly distributed, at least 4 inches thicker than other stones; minimum 20 percent of wall area. Vertical joints should be staggered.

FOOTINGS

General.—Footings should be constructed of poured concrete adequate to support the structure without appreciable settlement and should be carried to firm soil at a depth below grade level not less than the depth usually considered adequate for the area in which the structure is to be built. Reinforce with steel bars where footings cross pipe trenches or similar unstable areas.

Stepped Footings.—Where variations in the elevations of the bottom of wall footings are necessary, as may occur in the case of hillside properties, the vertical connection between footings at the step will be constructed of concrete 4 inches thick and the same width as the footing. The steps will

be poured continuous with the footings. The vertical steps will not exceed the horizontal distance between steps.

Footing Drain Tile.—Should be used when water and soil conditions warrant.

Protect top of joints with strips of building paper and cover tile with 12 inches of gravel or other porous material.

CONCRETE SLABS ON GROUND

Bed Under Slabs.—Bed under slabs should be at least 4 inches thick of clean, uniformly graded gravel, or crushed rock; cinders may be used under slabs except slabs used for finish floors, or as a base for other floor finish. Earth under slab bed should be leveled and tamped.

Wire Mesh Reinforcing.—Wire mesh reinforcing, when required, should have a minimum weight of 20 pounds per 100 square feet.

Cement Floor Finish.—Cement floors should be suitably finished for the purpose intended.

Concrete slab should have integral finish, or

Topping—minimum mix—1 part portland cement, 3 parts sand, minimum thickness—1 inch.

Slabs on Ground.—Used as a finish floor or as a base for other floor finish in habitable rooms, slabs on ground should:

Have a minimum thickness of 4 inches.

Be waterproofed unless it is known that water table, soil, and drainage conditions offer no problem. If membrane waterproofing is used, extend to exterior walls and turn up to top of slab. A continuous waterproofed insulation strip at least one-half inch thick should be installed between the exterior wall and the floor slab.

Basement Floor Slabs.—Basement floor slabs should have a minimum thickness of 3 inches. Slope finish floor slab to drain.

Terrace and Porch Floor Slabs.—Terrace and porch floor slabs should have a minimum thickness of 4 inches.

Slab bed required in paragraph, Bed Under Slabs, may be omitted if slab is reinforced.

Where concrete slabs abut wood construction, metal flashing should be provided between the slab and the wood construction.

FOUNDATION WALLS

Walls supporting frame construction should extend not less than 8 inches above adjoining outside finish grade.

In case of walls supporting masonry veneered wood frame, the foundation should be extended so that the wood construction is not less than 6 inches above outside finish grade.

Area walls, concrete steps, and platforms should be anchored or bonded to the foundation wall.

Minimum Thickness.—Minimum thickness for poured concrete foundation walls should be:

1. Six inches for walls supporting wood frame structures less than two stories high without basements.
 2. Eight inches for all other poured concrete walls.
- Minimum thickness for masonry unit walls should be:
1. Eight inches for masonry unit foundation walls.
 2. Rubble stone walls should have a minimum thickness of 12 inches.

PIERS

In very mild climates, frame dwellings may be supported on masonry or poured concrete piers, and except in very mild climates, a continuous foundation wall or a curtain wall between piers should be provided when the first floor is raised above the ground.

DAMPPROOFING AND WATERPROOFING

Basement and cellar walls should be dampproofed on exterior from finish grade to outside edge of footing, forming a cove at the intersection of wall with footing.

Masonry Unit Walls.—Apply one-half-inch thick portland cement plaster coat, over which apply at least one heavy coat of undiluted hot tar, hot asphalt, or other suitable compounds. The joint at intersection of wall and top of footing should be caulked with elastic caulking compound before the plaster coat is applied.

Poured Concrete Walls.—Apply at least one heavy coat of undiluted hot tar, hot asphalt, or other suitable compounds.

Note.—In certain site locations, where water conditions are known to offer no problem, the above requirements may be omitted.

BASEMENTLESS AREAS

Ground level should be at least 18 inches below bottom of floor joists and girders.

Where the interior ground level is below outside finish grade, adequate precautionary measures should be taken to assure positive drainage at all times.

EXTERIOR MASONRY WALLS

Minimum thickness—8 inches.

Furring not less than three-fourth-inch (finish thickness) wood strips should be installed on exterior masonry walls less than 12 inches thick unless such practice is not customarily required in the area.

Lintels supporting masonry over openings should be steel or reinforced concrete; or masonry arches should be installed. Lintels should have a minimum of 4 inches bearing upon solid masonry or concrete at least 4 inches thick.

MASONRY VENEER

Minimum Thickness.—Brick— $3\frac{3}{4}$ inches.

Ashlar stone masonry for dwellings less than 2 stories high—3 inches; for 2-story dwellings—4 inches.

Masonry Veneered Wood Frame Construction.—Veneer should be applied over sheathing with air space between.

Air Space.—Provide 1 inch minimum air space between masonry veneer and sheathing.

Base Flashing.—Lightweight roll roofing or waterproofed building paper should extend over top of foundation wall from outside face of wall and should extend not less than 12 inches up on sheathing.

Water-Resistant Building Paper or Saturated Asphalt Felt.—Should be applied over sheathing. Overlap base flashing at least 4 inches.

Bonding.—Corrosion-resisting metal ties spaced not more than 15 inches vertically and 32 inches o. c., horizontally. When other than wood board sheathing is used, secure ties through to studs.

Weepholes.—Approximately 8 feet o. c., should be provided by omitting the mortar in vertical joints at bottom course of veneer.

INTERIOR MASONRY WALLS

Bearing Partitions.—Masonry units, when supporting not more than 1 floor, and ceiling joists which carry no load—6 inches; otherwise—8 inches.

Lintels should be steel, reinforced concrete, stone, or masonry arches. Minimum 4-inch bearing should be provided by solid masonry at least 4 inches thick.

Joists should bear on solid masonry at least 4 inches thick.

Girders should bear on solid masonry or concrete at least 6 inches thick.

Nonbearing Partitions.—Minimum thickness—3 inches.

Lintels should be steel, reinforced concrete, masonry arches, or reinforced structural clay tile.

MASONRY CHIMNEYS AND FIREPLACES

Chimneys and flues should be so constructed as not to be fire hazards. All masonry chimneys should be built from the ground up and except for those with solid brick walls 8 inches thick, or more, should be lined with fire-clay lining.

Separate flues are required for each appliance which depends upon sustained chimney draft for proper operation.

The chimney should be of such height, size, and construction as to create sufficient draft to develop the rated output of the equipment served and not less than recommended by the equipment manufacturer. In no case should the height be less than 2 feet above the ridge of the roof that the chimney penetrates and not less than 2 feet above the highest ridge within 10 feet of the chimney.

Masonry type chimneys are acceptable for use with all fuels. Other chimneys, flues, or vents may be used if approved by the National Board of Fire Underwriters for the fuel used.

Fireplace flues should be not less than one-tenth of fireplace opening.

Thimbles should be built in at the time the chimney is constructed. Where thimbles extend through frame walls, the masonry should be corbelled out flush with the face of the frame.

Flue linings should extend not less than 6 inches below the bottom edge of thimble openings.

Chimney cap should be provided to form wash from flue to outside edge of chimney.

Smoke chambers should be provided in all fireplaces and the fireplace should be lined with firebrick, except in instances where metal fireplace units are used.

Fireplace hearths should be supported on concrete or masonry and should extend at least 16 inches from the chimney breast and be at least 16 inches wider than the fireplace opening.

WOOD CONSTRUCTION

LUMBER

Softwood Framing and Board Lumber.—Softwood framing and board lumber should comply with American lumber standards and with grading requirements of the association recognized in the trade as covering the species and under whose grading rules it was produced.

Framing Lumber.—All species of softwood framing lumber may be used subject to the maximum allowable spans for the particular species, grade, and use.

Board Lumber for Subflooring, Sheathing, and Similar Uses.—No. 3 common or better for Douglas Fir (Coast region), Sitka Spruce, Southern Cypress, West Coast Hemlock, California Redwood, Cedar, Eastern Hemlock, Tamarack, and Southern Yellow Pine.

No. 4 common or better for White Fir, Douglas Fir (Inland region), Western Larch, Spruce (except Sitka), Ponderosa Pine, Sugar Pine, Idaho White Pine, Northern White Pine, and Norway Pine.

All Lumber Will Be Well Seasoned.—Lumber 2 inches thick and less should have moisture content not to exceed 19 percent. Wood siding, interior, and exterior trim should have moisture content not to exceed 12 percent.

FRAMING—GENERAL

Structural Framing Members.—Splices should not be made between bearing points.

When structural strength is impaired by cutting, drilling, or by inherent defects, members should be replaced or reinforced.

Framing at Chimneys.—Framing members should not bear on chimney masonry. Piers built integral with chimney may be used.

Framing members should be not closer than 2 inches to chimney masonry.

Firestopping.—Partitions, outside stud walls, and furring space on masonry walls should be firestopped at first floor and at attic.

Wood blocks or masonry, tightly fitted, may be used.

FLOOR FRAMING

Columns and Posts.—Wood posts in basement should bear on a concrete base resting on footing; top of base should be 3 inches above finish floor; securely fasten top of post to girder. If necessary for full bearing, install bearing plate or cap secured to both post and girder.

Girders.—Spans for wood girders should be determined in accordance with sound building practice.

Joints of solid and built-up wood girders should be made over pier or column supports only.

Provide one-half-inch airspace at end and each side of wood framing into masonry.

Floor Joists.—The maximum allowable joist spans for the particular size and species of wood to be used should be determined.

For framing into headers or side of wood girders, use steel joist hangers, or wood bearing strip, at least 2 x 2 inches. Joists should not be notched more than one-fourth of joist depth.

For framing into masonry:

1. Minimum joist bearing—3 inches.
2. Ends of joists should have 2-inch fire cut or bevel.
3. Airspace each side of joist—one-half inch.
4. All floor joists except first floor joist framing into masonry walls—anchor end of each fourth joist to masonry metal straps (**T** anchors) applied near bottom of joists.
5. All joists except first floor joists, parallel with masonry should be tied to masonry with metal straps spaced not more than 8 feet o. c. extending over and secured to at least three joists.

Framing Over Girders and Bearing Partitions.—Ends of joists should be lapped and spiked together or butted over center of bearing. When butted, tie with metal straps ($\frac{1}{8}$ x 1 x 18 inches minimum), or 1-inch thick wood ties at least 2 feet long. Nail joists to bearing.

Double Joists.—Joists should be doubled under all partitions when parallel to floor joists. Provide additional joists as required to support unusual loads.

Headers and Trimmers.

1. Headers 4 feet or less in length may be single and should be supported by wood bearing strips or other acceptable support.
2. When openings occur at end of joist span and header is 4 feet or less in length, trimmers may be single.

3. Double framing should be used under all other conditions.

Notching top or bottom of joists not more than one-sixth joist depth for piping and duct work should be made in end third of span only; otherwise, header should be installed.

Floor joists with spans greater than 8 feet should have one row of cross bridging in the center. Where spans are greater than 16 feet, 2 lines of bridging should be provided.

Subflooring.—Subflooring should be installed except in mild climates, where single floor construction is generally acceptable. When subflooring is omitted the finish flooring should have a minimum thickness of $\frac{3}{4}$ inch.

Wood Boards.

1. Thickness—1 inch; maximum width should be—8 inches.

2. Ends of boards should be cut parallel to and over center of joists.

3. Nailing—boards should be double-nailed at each bearing, except 8-inch boards which should be triple-nailed.

4. Clearance—provide one-half inch clearance between subfloor and all masonry walls and partitions.

CEILING FRAMING

Joists.—The maximum allowable ceiling joist spans for the particular size and species of wood to be used should be determined.

Use ceiling joists as ties for rafters whenever possible.

ROOF FRAMING

General.—Headers and Trimmers.

1. Headers 4 feet or less in length may be single.

2. When chimney is at ridge or eaves and header is 4 feet or less, trimmers may be single; double framing should be installed under all other conditions.

3. Double headers and rafters should be installed at dormer windows which are not supported on partitions.

Wall plates for rafters and roof joists should be anchored to masonry walls.

Pitched Roofs.—The maximum allowable rafter spans for the particular size and species of wood should be determined.

Rafters should be cut for level bearing and spiked to wall plate; frame rafters opposite one another at ridge; provide tie for rafters to prevent thrust.

Collar Beams.

1. Minimum size—1 x 6 inches or 2 x 4 inches; maximum spacing—1 collar beam every third rafter.

2. When collar beams are above the lower third of the rafters and ties are not provided at the plate line, provisions should be made for tying the lower end of rafters to floor, ceiling, or wall construction. If the collar beams serve as ceiling joists in such cases, they should be of same thickness and spacing as rafters.

Hip and Valley Rafters.

1. Minimum thickness—2 inches; minimum depth—not less than cut end of jack rafters. Design to carry the loads imposed.

2. Crickets or chimney saddles should be installed at upper side of all chimneys not in contact with ridge.

EXTERIOR WALL AND BEARING PARTITION FRAMING

Studs.—Minimum size—2 x 4 inches.

Maximum spacing—for all 2-story construction—16 inches o. c.; for construction less than 2 stories—determined by the type of interior finish when walls are sheathed and by the type of exterior or interior finish when walls are unsheathed; the lesser permissible spacing should govern. Maximum in any case—24 inches o. c.

Maximum length for balloon frame—20 feet; notch studs at second floor to receive 1 x 4 ribbon; nail joists to studs.

Corner Construction.—Corner posts should be not less than three 2 x 4's set to receive interior finish.

Corners of rooms should be framed to receive interior finish.

Corner Bracing.—Braces should be installed at all external corners extending from sill to plate, except as provided below:

Openings near corner—use knee braces extending from corner post to sill and to top plate; extend over at least three stud places.

Openings at corner—brace as provided in paragraph above; set as near opening as possible.

Corner braces may be omitted only when:

1. Wood sheathing boards are applied diagonally, or
2. Plywood sheathing (4 x 8-foot sheets) is nailed with sixpenny nails, 6 inches o. c., on all edges and 1 foot at intermediate bearings.

Sill Construction.—Sills and girders on top of foundation walls and piers should be leveled and grouted with portland cement mortar; wood is not satisfactory for permanent shims.

Window and Door Openings.—Inner stud on jambs should extend in one piece from header to bearing and should be nailed to outer stud.

Headers over all openings should be doubled and set on edge. Spans should not exceed the following for the sizes given: two 2 x 4's, spans up to 4 feet; two 2 x 6's, spans up to 5½ feet; two 2 x 8's, spans up to 7 feet; two 2 x 10's, spans up to 8 feet. In lieu of headers, properly designed trussed construction may be used. Where headers support concentrated loads or are subject to other unusual loading conditions, the header should be specially designed.

Plates.—Top plates should be two 2 x 4's. Plate members should be lapped at corners and intersecting partitions; when plates are cut for piping or duct work, install steel angle tie for plate and bearing for joists.

Sole plates should be 2 inches minimum thickness; exterior wall studs may bear on the sill or on a sole plate on top of subfloor.

WALL SHEATHING

Wood Boards.—Minimum thickness—1 inch; maximum width—8 inches unless tripled-nailed; maximum stud spacing—24 inches o. c.

Break joints over center of studs unless end-matched (T and G) boards are used; if end-matched, no two adjoining boards should break joints over same stud space and each board should bear on at least two studs.

Application—when applied diagonally, boards should extend at 45 degrees in opposite directions from each corner; apply horizontally under stucco finish.

Plywood.

Minimum thickness	Maximum stud spacing
$\frac{5}{16}$ inch	16 inches
$\frac{3}{8}$ inch	24 inches

Types of finish which affect the minimum thickness of plywood used:

1. Under wood shingles: If $\frac{5}{16}$ -inch plywood is used, apply shingles over 1- x 2-inch nailing strips using copper or galvanized nails for attaching the shingles. Nailing strips may be omitted if barbed nails are used for attaching the shingles.

2. Under asbestos-cement shingles and siding—if $\frac{5}{16}$ -inch thick plywood is used, apply siding or shingle material with barbed nails. Do not apply over wood nailing strips.

Fiber Board.

Minimum thickness	Maximum stud spacing
$\frac{1}{2}$ inch	16 inches
$\frac{3}{4}$ inch	24 inches

Under wood shingle siding: apply 1- x 2-inch nailing strips over sheathing, spaced according to shingle exposure.

Fiber board is not acceptable as a nailing base.

1- x 3-inch nailing strips may be applied directly to the studs and underneath the sheathing, spaced according to shingle exposure, provided shingle material is applied with nails at least 2 inches in length.

Gypsum Board.—Minimum thickness, one-half inch; maximum stud spacing—16 inches.

Under wood shingle siding: apply 1- x 2-inch nailing strips over sheathing, spaced according to shingle exposure.

Gypsum board is not acceptable as a nailing base.

1- x 3-inch nailing strips may be applied directly to the studs and underneath the sheathing, spaced according to shingle exposure, provided shingle material is applied with nails at least 2 inches in length.

Sheathing Paper.—Install over stud walls when sheathing is not used and over all types of sheathing except water-resistant fiber boards.

Apply shingle fashion, 4-inch lap; lap 4 inches on strips around openings. Strips of sheathing paper at least 6 inches wide should be installed behind all exterior trim of exterior openings without exception.

ROOF SHEATHING

Wood Boards.—Minimum thickness—1 inch; maximum width—8 inches; maximum rafter spacing—24 inches o. c.

Break joints over center of rafters unless end-matched (T and G) boards are used; no two adjoining boards, if end-matched, should break joints over the same rafter space and each board will bear on at least two rafters.

Application—lay closed under any roof material except that under wood shingles, use 1- x 3-inch shingle lath spaced according to shingle exposure, and under galvanized iron roofing, not less than 1 ¼-inch thick nailers spaced in accordance with manufacturer's recommendation may be used instead of closed sheathing.

PLYWOOD

Roofing material	Rafters maximum spacing	Plywood minimum thickness
	<i>Inches</i>	<i>Inches</i>
Wood and asphalt shingles	16	5/16
	24	3/8
Slate, tile, and asbestos-cement	16	1/2
	20	1 1/2
	24	5/8
Flat roofs	16	3/8
	20	1/2
	24	5/8

Application.—Apply grain of outer plys at right angles to rafters.

Under Wood Shingles.—Apply 1- x 2-inch nailing strips over plywood less than one-half-inch thick, spaced according to shingle exposure.

Protection.—Outer edges of plywood along eaves and rake of roof, and edges and faces within 6 inches of outer edges will receive 2 heavy coats of white lead paint. Also protect outer edges with moldings or sheet metal flashing. Flashing along eaves may be integral with gutters. If gutters are not installed, form the flashing to provide a drip.

CAULKING

Caulk around exterior openings where required in order to provide weathertight construction.

PROTECTION AGAINST TERMITES

In localities where protection against infestation by termites is needed, such protection should be afforded by either the following means: (1) Continuous corrosion-resisting sheet metal termite shields with tight seams or soldered joints, or (2) lumber treated with wood preservatives for all wood construction in contact with foundation walls or piers and all first floor framing. The full-cell or empty-cell process or the hot and cold bath

process are acceptable methods of treating lumber with preservatives. Brush coat, spraying, or dipping methods of treatment are not satisfactory when preservative treatment is necessary.

VAPOR BARRIERS

In conventional frame walls where sheathing paper is required and where insulation is not installed within the stud spaces, use a water-resistant sheathing paper or felt having low vapor resistant characteristics (high vapor permeability).

In all frame walls of conventional or similar construction where insulation is installed within the stud spaces, the installation of a vapor barrier on the warm side of the wall should be used. Vapor barriers should be installed as continuous as practicable and should be securely fastened at top, sides, bottom and at any intermediate framing. Make perforations of the barrier, required for the installations such as electric outlet boxes, so that there is a minimum of free opening.

EXTERIOR WALL FINISH

GENERAL

All exterior finish should be backed up with water-resisting building paper or saturated asphalt felt, except in instances where a sheathing board which has been factory-treated to render it water resistant is used. Material of a high vapor resistance should not be used as a sheathing paper unless a material of higher vapor resistance is used on the inside of the wall.

Sheathing paper should be installed over the stud frame when sheathing is not used.

WOOD SIDING

Bevel Siding.—Maximum width of siding—10 inches.

Minimum headlap—1 inch for 4- and 6-inch width; 1¼ inches for widths over 6 inches.

Nail at each bearing with hot-dipped galvanized nails.

Rustic and Drop Siding.—Minimum thickness—¾ inch (finished); maximum width—8 inches (nominal).

Nail at each bearing with hot-dipped galvanized nails.

Shiplap or Matched Siding (flush).—Minimum thickness—¾ inch (finished); maximum width—12 inches (nominal).

Nail at each bearing with hot-dipped galvanized nails.

When boards are applied vertically, set edges in white lead.

WOOD SHINGLE SIDING

Shingle Grades.—Single course siding—No. 1 or 2.

Double course siding—No. 1 for exposed shingles; under course may be No. 2 or 3.

Maximum Exposure.

Shingle length	Single course exposure	Double course exposure	
		No. 1 grade of outer course	No. 2 grade of outer course
<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
16	7½	12	10
18	8½	14	11
24	10	16	14

Nailing.—Nails should be copper or hot-dipped galvanized. Butt nail double coursing; exposed nails will be small-headed.

ASBESTOS-CEMENT SIDING AND SHINGLES

Apply clapboards and shingles in accordance with manufacturer's recommendations.

Apply over solid sheathing. If applied over sheathing other than wood boards or plywood, special method of attachment should be used.

Nails or other means of attachment should be noncorrodible.

STUCCO

Mixture.—One part portland cement, 3 parts sand, and hydrated lime equal to 10 percent of cement by volume; or prepared portland cement stucco used in accordance with manufacturer's recommendations.

Thickness.—Three-coat work—1-inch total; 2-coat—5⁄8-inch total.

Application.—Three-coat work should be used over wood frame.

Two-coat work should be used over masonry surfaces.

Finish coat may be trowel coat of prepared exterior stucco.

Thoroughly cover and embed lath in stucco.

Keep wet 3 days after application of each coat.

Drying time between coats—4 days.

Stucco should not be applied when temperature is less than 40° F.

Stucco applied over wood lath is not satisfactory.

ROOF COVERING AND FLASHING

SHINGLE ROOFS (EXCEPT PORCHES)

Shingle roofs (except porches) should have a minimum slope of 4 in 12; for shingle and tile porch roofs the minimum slope should be 3 in 12.

Double starting row should be used on all shingle applications.

ASPHALT SATURATED FELT UNDERLAY

Asphalt saturated felt underlay should be provided as follows:

Approximately 30 pounds per 100 square feet under tile, asbestos-cement shingle, or slate roof.

Approximately 15 pounds per 100 square feet under asphalt shingles, or in lieu, an asphalt coated building paper, approximately 10 pounds per 100 square feet.

No felt should be required under asphalt shingles on roof slopes of 7 in 12 or more, or when triple shingle thickness is obtained at all points.

In areas subject to freezing temperatures, shingled roofs with overhang exceeding 12 inches, should be provided with an eaves flashing strip of not less than 55-pound smooth rolled roofing, extending up the roof to a point, not less than 12 inches inside the inside wall line of the building. When the overhang requires the strip to be wider than 36 inches, the horizontal lap should be made on the lower portion of the roof deck beyond the outside wall line of the building. Lap should be cemented.

ASPHALT SHINGLES

Asphalt shingles should bear Fire Underwriters' Class "C" label and should be applied in accordance with manufacturer's recommendations.

Approximate minimum weights per 100 square feet (shipping weight) :

Square butt strip.....	210 pounds.
Hexagonal strip.....	215 pounds.
Individual shingles.....	250 pounds.
Interlocking shingles.....	215 pounds.

In areas where high winds are a hazard each tab of shingle should be secured by spot cementing with special cement recommended by the manufacturer.

WOOD SHINGLES

Wood shingles should be edge grain tapered shingles (No. 1 Grade).

(Minimum Size):

Length (inches)	Thickness
16.....	5 butts in 2 inches.
18.....	5 butts in 2¼ inches.
24.....	4 butts in 2 inches.

(Maximum Exposure):

Slope of roof		Exposure for shingle lengths in inches		
Rise	Run	16	18	24
Under 5.....	12	3¾	4¼	5¾
5 and over.....	12	5	5½	7½

Underlay is not required.

ASBESTOS-CEMENT SHINGLES

Asbestos-cement shingles should bear Underwriters' Class "A" or "B" label and should be applied in accordance with manufacturer's recommendations.

GALVANIZED SHEET METAL ROOFING

Galvanized sheet metal roofing should be not less than 29 gage with 1.25 ounce zinc coating per square foot. Application should be in accordance with manufacturer's recommendations.

BUILT-UP ROOFING

Built-up roofing should comply with the requirements of Underwriters' Laboratories, Inc. The covering should be at least 3 plies—the minimum weight of each ply of felt should be 13 pounds per 100 square feet. Roofing gravel or crushed stone should weigh approximately 400 pounds per 100 square feet up to 1 in 12 pitch, and 275 pounds per 100 square feet for 3 in 12 pitch (proportionately in between). If crushed slag is used, the weight should be approximately 300 pounds per 100 square feet. Top ply of felt and crushed stone or slag surfacing may be replaced with 1 layer of mineral surfaced cap sheet, minimum weight 85 pounds per square. All should be applied in accordance with manufacturer's directions.

FLASHING

Flashing should be installed over exterior heads of openings, around chimneys, at intersections of roofs and walls, valleys, hips, ridges, and at horizontal and vertical intersections of stucco and other materials where required to make the work weathertight and to protect the structures from decay. Flashing should be installed at sills of openings in masonry veneer or solid masonry walls. Flashing should be corrosion-resistant metal except that for valleys in connection with asphalt shingle roofs, 2 thicknesses of mineral surfaced roll-roofing cut from rolls weighing not less than 85 pounds per square may be used, and for heads of openings in wood frame walls, 3-ounce copper-coated building paper may be used, provided flashing is not exposed to weather more than 2 inches. Metal flashing may be 29 gage galvanized metal, 16-ounce soft copper, 40-pound terneplate or other materials suitable for this purpose.

Flashing at heads of openings may be omitted when the vertical height from the head of the opening to soffit of eaves is at least $\frac{1}{4}$ less than the effective projections of eaves from face of wall.

All masonry and concrete foundation walls, beams, piers, and slabs, should be separated from wood framing with a dampproof course of at least 1 layer of 30-pound saturated felt.

All chimney and roof intersections should be flashed and counterflashed with sheet metal flashing.

For roofs with slopes less than 7 in 12, minimum width of flashing 18 inches; on roofs of slopes 7 in 12 or more, minimum width of flashing 12 inches.

Sheet metal flashing should be provided along all edges of concrete porches which abut wood construction to completely separate the wood from masonry or concrete.

INTERIOR WALL AND CEILING FINISH

LATH AND PLASTER

Expanded Metal Lath and Woven Wire Fabric.—Maximum spacing of supports should be in accordance with approved practice for the weight and gage of the materials used.

Galvanized Wire Fabric.—Used with paper backing. Paper—absorbent quality or perforated.

Minimum size of wire—16 gage; maximum mesh—2 x 2 inches; maximum spacing of supports—16 inches o. c.; when used on ceiling, paper backing should be combined integrally with wire fabric.

Insulating Fiber Board Lath.—Minimum thickness— $\frac{1}{2}$ inch. Lath size—18 x 48 inches. Lath 24 x 48 inches may be used provided all joints at right angles to the framing members are covered with continuous strips of metal lath and ends of lath are nailed to solid bearing (framing members at approximately 4 inches o. c. including intermediate supports).

Maximum stud or joist spacing—16 inches o. c.

Apply in accordance with manufacturer's directions.

Gypsum Board Lath.—Minimum thickness— $\frac{3}{8}$ inch for stud or joist spacing, 16 inches o. c., and $\frac{1}{2}$ inch for stud or joist spacing 24 inches o. c.

Size—16 x 48 inches.

Apply in accordance with manufacturer's directions.

Lathing.—At heads of openings, lath should be installed so vertical joints of first course of lath above head will not occur on jamb studs.

Corner beads, galvanized, should be installed on all external corners.

Cornerites of metal lath or wire fabric should be installed, except where special clip systems are used for installing the lath and the manufacturers of such systems do not recommend cornerites. Minimum width of cornerites 4 inches, 2 inches on each surface of internal angles.

Over solid wood surfaces, install metal lath on strips or use furring nails. Metal lath will be lapped on adjoining lath surfaces.

Plaster.—Mix all plaster (lime and prepared) according to manufacturer's recommendations.

Quick (lump) lime should be thoroughly slaked.

Plaster should be applied in 3-coat or 2-coat doubleup work; minimum thickness— $\frac{1}{2}$ inch over lath or masonry base.

BATHROOM INTERIOR FINISH

Materials.—Waterproof finish wall materials should be installed in showers and over bathtubs where showers occur.

Installation.—Install in accordance with manufacturer's instructions.

In showers; minimum height—6 feet; over bathtubs where showers occur, minimum height above rim—4 feet.

When applied surface materials are used, joints at corners, bathtub, top edge of wainscot, and at intersections of wainscot and other materials should be caulked and protected.

DRY WALL FINISH

Type of finish	Spacing of framing members (inches)		
	16	20	24
	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
Plywood	1/4	*1/4	3/8
Gypsum board	3/8	1/2	*1/2
Fiber board	1/2	3/4	3/4

* Apply long dimension at right angles to framing members.

For stud spacing exceeding 16 inches o. c., solid blocking should be installed behind all joints at right angles to framing members.

Other types of boards, including compressed dense composition board less than 1/2 inch thick may be used.

FINISH FLOORS

WOOD

Materials.—Flooring should be kiln-dried material.

Strip Flooring:

1. Hardwood—minimum thickness, 5/16 inch.

2. Softwood—minimum thickness, 25/32 inch.

3. Maximum width—3 1/4 inches. Wider widths, including plank flooring, may be used when precautions are taken in installation to prevent warping or cupping.

Building paper or deadening felt should be applied under all finish flooring.

Installation.—Finish flooring should be applied at right angles to wood board subflooring except when subflooring is laid diagonally.

Strip flooring installed over concrete should be applied on not less than 2 x 2-inch sleepers embedded in concrete at not more than 16 inches o. c., or secured with metal clips to concrete. Sleepers embedded in concrete should be pressure-treated with a wood preservative.

Wood block flooring applied over concrete should be set in mastic and installed in accordance with flooring manufacturer's directions.

CERAMIC TILE

Grade.—Grade should be standard grade or better.

Setting Bed.—Mix—1 part portland cement, 4 parts sand; or 1 part portland cement, 2 parts sand, and 4 parts pea-size aggregate.

Thickness—1¼ inches, if reinforced with wire mesh; 3 inches when installed below top of chamfered joists, with finish tile surface at least 1½ inches above tops of joists.

When applied over wood subfloor, install asphalt saturated felt over subfloor underneath the wire mesh.

RUBBER TILE, ASPHALT TILE, AND LINOLEUM

Rubber tile or linoleum should not be applied on slabs resting on ground. Asphalt tile may be used on slabs resting on ground when precautions have been taken to prevent penetration of ground water into slab. Install according to manufacturer's instructions.

Install over lining felt, approximately 1 pound per square yard, when applied over wood subflooring.

GLAZING, PAINTING, AND DECORATING

WINDOW GLASS

Quality.—Minimum—B quality.

Strength.—Glass panes exceeding 12 inches in least dimension when installed in doors should be not less than double strength, otherwise, single strength may be used.

INSTALLATION

In Wood.—Glass set in wood should be secured in place with sprigs or glazing points and face-puttied. In doors, bed in putty and secure with wood stops.

In Metal.—Glass set in metal will be back-puttied and secured with glazing clips. Use special steel window putty.

PAINTING AND DECORATING

All millwork should receive a prime coat before or immediately after installation.

All exterior woodwork should receive 3 coats of paint, including the prime coat, except wood shingles and half-timber work which may receive 2 coats of stain or penetrating oil.

All exterior surfaces of concrete block walls should receive two coats of paint specially prepared for painting concrete surfaces. The first coat should be applied by scrubbing paint on with a stiff bristle brush. After application of cement-water paint, special attention should be given to curing by sprinkling gently with water for several days.

Ornamental iron, structural steel, and steel sash should be painted with lead in oil, graphite, or prepared paint as recommended by manufacturer. Apply at least one coat in addition to shop coat.

All interior trim and all sash should be stained, painted, varnished, or waxed.

If painted: apply 1 prime coat and 1 finish coat; and if open-grained wood: 1 coat filler before application of paint coats.

If stained: stain and 1 coat of varnish; or stain and 1 coat of wax.

If natural wood finish: 2 coats of varnish; or 2 coats of wax; or 1 coat of varnish and 1 coat of wax.

Plaster may be painted, papered, or left natural, except that plaster in bathrooms and kitchens should be painted or papered. If painted, use oil base paint. If papered, use water repellent paper.

Wallboard or paneled walls: stain, paint, or paper. Apply finish according to manufacturer's directions.

All wood floors should be sanded and finished. Floors may be finished as follows:

1. Two coats of wax.
2. Stain and 2 coats of wax.
3. One coat shellac, varnish or lacquer, and one coat of wax.
4. Two coats of varnish.
5. Two coats of floor enamel and one coat of wax.
6. One coat of sealer and two coats of wax.
7. Three thin coats of thin shellac.
8. Prefinish applied at the factory may be used.

FINISH HARDWARE

Install hardware commensurate with class of dwelling.

Three butts should be used on all exterior doors.

WATER SUPPLY, PLUMBING, AND SANITATION

Domestic Water Supply.—The domestic water supply must be adequate, convenient, and uncontaminated. The source of water must be situated so as to avoid pollution from barn and outdoor toilets, sewage disposal fields, and other sources. Wells must have concrete slab covers with sanitary type pumps installed.

Plumbing.—The installation of all plumbing work must comply with the requirements of the applicable local and State regulations. In the absence of local and State regulations, the requirements contained in "Recommended Minimum Requirements for Plumbing," published by the National Bureau of Standards, should apply.

Sanitation.—Privies and other individual sewage disposal systems must meet applicable local and State regulations as to design and location and, in the absence of such regulations, should meet the minimum requirements recommended by the Joint Committee on Rural Sanitation for Individual Sewage Disposal Systems as published by the United States Public Health Service.

LIQUEFIED PETROLEUM GAS

The installation and construction of all containers, piping, appliances, and other pertinent equipment for the storage and using of liquefied petroleum gas must comply with the requirements of the applicable local and State regulations. In the absence of such regulations, the recommended practices of the National Fire Protection Association, Pamphlet No. 52, will apply.

Piping for liquefied petroleum gas must be installed in such a manner as to insure its being run as direct as possible. Piping must not be installed in locations where seeping gas will be trapped and collect in hazardous concentration.

No appliance should be installed in a room in which the facilities for venting do not permit the proper combustion of gas under normal conditions of use.

Appliances must not be installed in any basement, semibasement, or other location where escaping gas may be trapped and collect in hazardous concentration.

HEATING

In climates where heating is required for winter comfort, each dwelling should be provided with facilities for heating. The type and quality of performance of the equipment should conform to the class of dwelling under consideration. Where central heating systems are proposed, the heating system should be of such capacity that under normal operation it will produce and maintain comfortable temperatures within all habitable rooms under weather conditions customarily to be expected in the area. All equipment and material should conform to approved standards and should be installed by experienced workmen familiar with the installation of the type of heating system to be used.

ELECTRICAL

Except in areas where electricity is not presently available and it appears unlikely that it will be available in the foreseeable future, all new houses should be wired for electricity when built. Consideration should be given to future as well as to present needs for electrical service on the farm when arranging for the service entrance installation.

Installations.—The installation of all electrical work must comply with all regulations applying to electrical installations in effect in the locality, or in the absence of such regulations, in accordance with the National Electric Code or the Specifications for Farmstead Wiring by the Rural Electrification Administration, and the regulations of the power supplier furnishing the service.

Circuits.—At least 1 circuit for each 500 square feet of floor area; a minimum of 3 per dwelling should be installed. Provision for at least one future circuit should be made.

Outlets.—Ceiling fixtures should be installed in kitchens, workrooms, halls, dining rooms, bedrooms, and basements.

One wall fixture and convenience outlet should be installed in the bathroom at the mirror.

One outside fixture should be installed at each main entrance and porch.

Convenience outlets should be installed as follows:

Living room should be provided with one duplex outlet between all doors, and between doors and fireplaces, when separated sufficiently for placement of furniture.

Dining room or dining space, one duplex outlet.

Kitchens, two duplex outlets.

Bedrooms, two duplex outlets.

For each unit of equipment, such as an electric range, a special purpose outlet.

Switches.

1. Each ceiling fixture in habitable rooms, halls, and basements should be controlled by a wall switch.

2. When ceiling fixtures are not installed, at least one outlet per habitable room should be controlled by a wall switch.

3. Bathroom fixture should be controlled by a wall switch not readily accessible from tub or shower.

4. At least one 3-way switch conveniently located on each floor to control at least one light which illuminates the stairs should be provided for a dwelling occupying more than one floor.

5. Exterior fixtures should be controlled by wall switches inside the entrance doors.

6. Switches should not be placed behind doors.

CONSTRUCTION OF SERVICE BUILDINGS

The information as set forth in paragraphs under Construction of Dwellings should be used for the construction of service buildings where applicable.

WATER SUPPLY, PLUMBING, AND SANITATION

Water supply, plumbing, and sanitation for service buildings must conform to the requirements as set forth in paragraphs under Domestic Water Supply, Plumbing, and Sanitation.

ELECTRICAL

Appropriate consideration should be given to the present and future needs for electrical service. Where electrical installations are made, all electrical work must comply with the standards set forth in the paragraphs under Installations (Electrical).

LIQUEFIED PETROLEUM GAS

The storage and handling of liquefied petroleum gas must conform to the requirements as set forth in Liquefied Petroleum Gas, as shown for dwellings.



